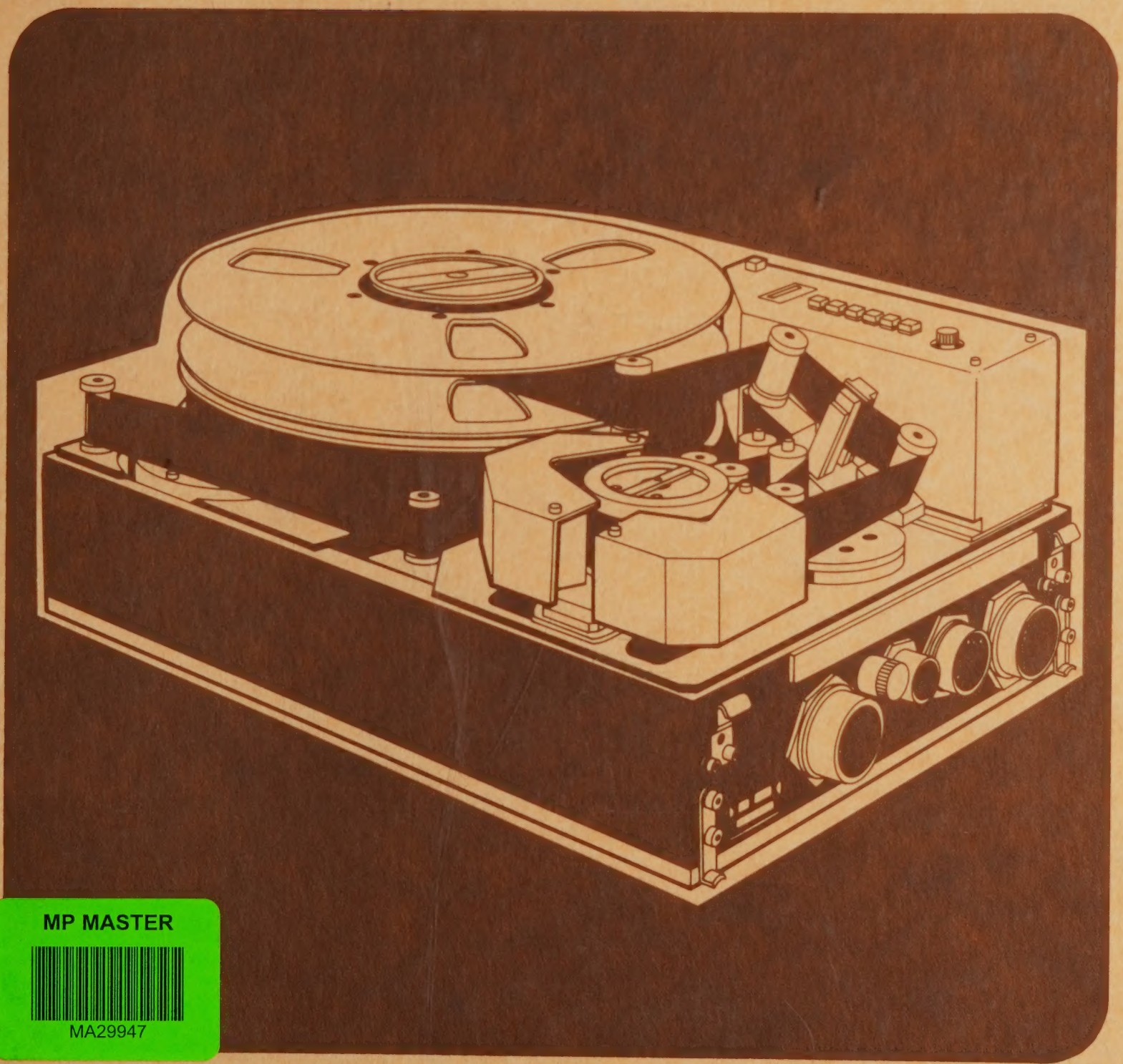
MODEL 12-B
RECORDER/REPRODUCER
OPERATOR'S MANUAL



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Data Systems Division (Recorders)

FAIRCHILD WESTON
Schlumberger

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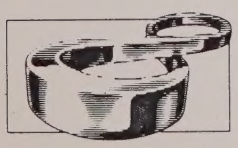

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SECTION 1

INTRODUCTION

1.1 PURPOSE

This manual provides the information necessary to operate the Model 12-B magnetic tape instrumentation data Recorder/Reproducer, (Figure 1-1).

1.2 SCOPE

This manual is comprised of five sections which contain information for operating this equipment (additional complete information for maintenance of the equipment is reserved for the maintenance manual which is under a separate cover). The scope of each of the five sections is as follows:

a. Section 1, Introduction - Provides the purpose and scope of this manual, general information about the Model 12-B Recorder/Reproducer, physical and electrical characteristics of the Model 12-B, and a block diagram which shows the components comprising the complete Recorder/Reproducer.

b. Section 2, Installation - Covers unpacking and inspection of the equipment when it is received, installation, and inter cabling preparation for use.

c. Section 3, Operation - Provides the information for basic operation of the Model 12-B Recorder/Reproducer, previously adjusted according to procedures in the maintenance manual and ready to use. The location of each local and remote control and indicator and its function is described. Also included are instructions for installing (and removing) tape reels, threading tape, and placing the Model 12-B in operation.

d. Section 4, Operator Maintenance - Contains the minor maintenance procedures to be performed by the operator.

e. Section 5, System Troubleshooting - Assists the user/operator in determining which assembly or module is at fault in the event of system malfunction.

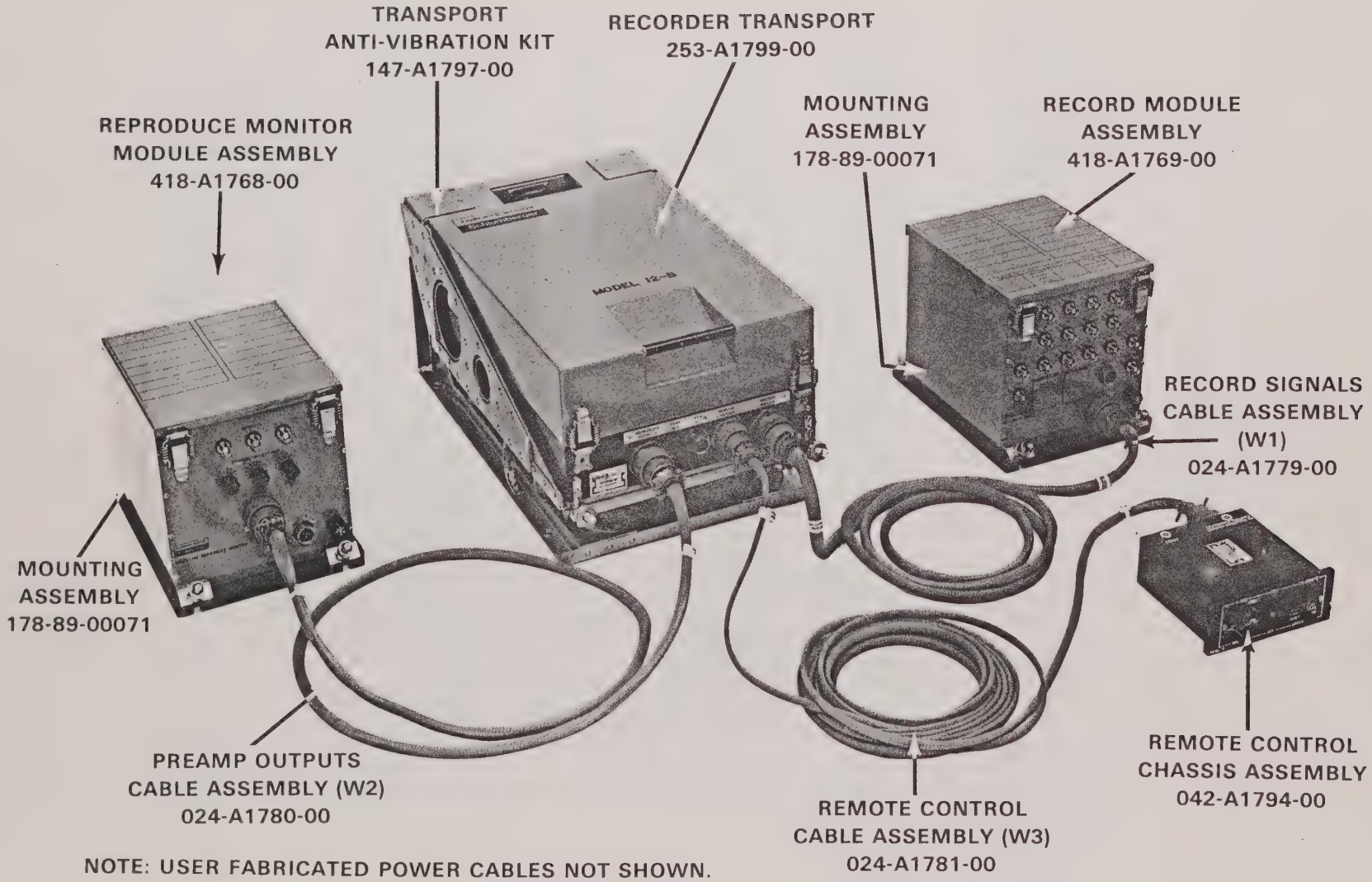


Figure 1-1. Model 12-B Recorder/Reproducer
(Part Number 253-A1800-00)

1.3 GENERAL INFORMATION

The Model 12-B magnetic tape instrumentation data Recorder/Reproducer is designed for use on aircraft, or other moving vehicle(s), where the vibration and temperature environment is severe, and where installation space is limited.

The Recorder/Reproducer is a wide band (0.4 kHz to 2.0 MHz) direct recorder that records 14 data tracks and two edge tracks A and B connected in parallel, forming one voice track, all on 1 inch wide magnetic tape. Its reproduce capability is comprised of three data channels, each of whose output is from the data track or the voice track selected by the front panel track selector switch for that channel.

Tape motion control and record or reproduce operation is accomplished either locally, by controls on the recorder transport, or remotely, by controls on the remote control chassis assembly.

The complete Model 12-B magnetic tape instrumentation data Recorder/Reproducer, is comprised of the elements shown by Figure 1-2, Detail, Block Diagram Recorder/Reproducer.

1.4 CHARACTERISTICS

1.4.1 Environmental Characteristics

Environmental (common to the recorder transport, record module assembly, reproduce monitor module assembly, and the remote control chassis assembly).

a. Temperature:

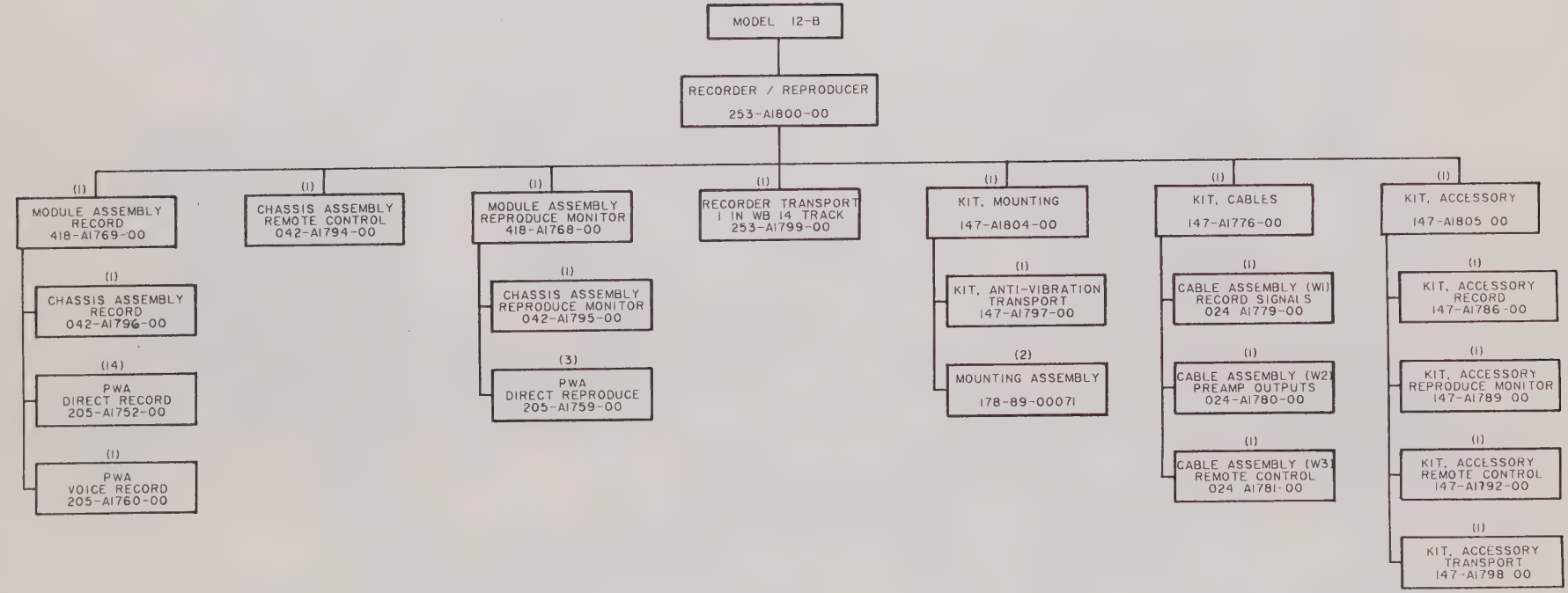
   1. Operating: -20°C to +70°C (altitude derated according to MIL-E-5400, Figure 3, page 2, curve A).

   2. Storage: -20°C to +100°C.

b. Vibration (Operating):

   1. $\pm$0.04 in. from 5 Hz to 13 Hz, 23 ft/s^2 from 13 Hz to 19 Hz, $\pm$0.16 in. from 19 Hz to 78 Hz and 330 ft/s^2 over 78 Hz (MIL-E-5400, Figure 2, curve 1).

c. Linear acceleration (Operating): $\pm$330 ft/s^2 along any axis.



1-2. Detail Block Diagram, Recorder/Reproducer (Model 12-B) 905-A1800-33

d. Impact (Operating): 495 ft/s^2 for a duration of 11 ms along any axis (MIL-STD-810).

e. Ambient pressure: 76000 feet, normal atmosphere.

1.4.2 Electrical Characteristics

Electrical (common to the recorder transport, record module assembly, reproduce monitor module assembly, and the remote control chassis assembly).

a. External electro-magnetic perturbation: To standard MIL-STD 461A and 462, tests CS01, CS02, RS01, and RS02.

b. Transmission perturbation: To standard MIL-STD 461A and 462, tests CE03, CE04, CE05 and RE02.

c. Bandwidth and signal-to-noise (S/N) ratio: Measured according to IRIG standards and shown in Table 1-1.

Table 1-1. Model 12-B Bandpass and S/N Ratio

Tape Speed (ips)	Bandwidth (kHz)	S/N (dB)
120	0.4 - 2000	26
60	0.4 - 1000	26
30	0.4 - 500	26
15	0.4 - 250	26
7-1/2	0.4 - 125	25
3-3/4	0.4 - 62	24
1-7/8	0.4 - 31	24
15/16	0.4 - 15.5	22

Time base supplied for reference track record: 200 kHz at 120 ips.

d. Primary power voltage

1. Normal operation: 22.0 V DC to 30.5 V DC (27 V DC, nominal.

2. Degraded performance: Between 18 V DC and 22 V DC.

NOTE

The Recorder/Reproducer will not operate when the primary voltage drops below 18 V DC but it will re-start automatically if the voltage is re-established above 18 V DC within ten seconds. If the voltage remains below 18 V DC form more than ten seconds, the Recorder/Reproducer must be re-started manually.

3. The Recorder/Reproducer can withstand interference in accordance with standard MIL-STD-704, Figure 9, curves 5 and 6.

1.4.3 Tape Transport Characteristics

a. Dimensions:

1. Length (depth): 15.75 inches
2. Width: 11.20 inches
3. Height: 6.30 inches

b. Weight:

1. Without tape reels and transport anti-vibration kit: 33.60 pounds.

2. With tape reels but without the transport anti-vibration kit: 40.90 pounds.

3. With tape reels and the transport anti-vibration kit: 53.25 pounds.

c. Tape reel size (diameter): 10-1/2 inches, maximum.

d. Tape width: 1 inch - Recommended type, Ampex 797 or equivalent.

e. Number of tape tracks: 14 plus voice (A and B paralleled).

f. Tape speeds:

1. Eight bi-directional speeds: 15/16 ips to 120 ips, operator selectable.

2. Recording/reproducing average tape speed accuracy (on internal sensor): $\pm$0.1%.

3. Fast forward (or reverse) tape speed (servo controlled): 240 ips.

g. Tape motion start or stop time: Less than five seconds (typically 3 seconds).

h. Automatic tape transport stop:

1. If the tape breaks
2. If the supply reel is empty
3. Absence of tape tension

i. Flutter: Measured according to IRIG standards and shown in Table 1-2.

Table 1-2. Model 12-B Flutter

Tape Speed (ips)	Vibration-Free Flutter (%)	Flutter With Vibrations (%)
120	0.22	0.24
60	0.26	0.30
30	0.28	0.52
15	0.30	0.8
7-1/2	0.35	1.5
3-3/4	0.40	1.8
1-7/8	0.60	2.0
15/16	1.00	2.5

j. Interchannel Time Displacement Error (ITDE): Measured according to IRIG standards and shown in Table 1-3.

Table 1-3. Model 12-B Interchannel Time Displacement Error (ITDE)

Tape Speed (ips)	ITDE, without Vibration (μs)	ITDE, with Vibration (μs)
120	±0.4	±0.5
60	±0.8	±1.5
30	±1.5	±10
15	±3	±30
7-1/2	±6	±40
3-3/4	±12	±90
1-7/8	±20	±180
15/16	±40	±360

k. Primary Power: 22 V DC to 30.5 V DC, (27 V DC, nominal).

l. Power Consumption: 150 Watts, maximum (except during acceleration, when it is approximately 220 watts for approximately 3 seconds).

1.4.4 Record Module Assembly Characteristics

a. Dimensions:

1.	Length (depth):	11.25 in., maximum (including the mounting assembly).
2.	Width:	7.80 in.
3.	Height:	8.25 in. (including the mounting assembly).

b. Weight:

1.	Without mounting assembly:	13.90 pounds
2.	With mounting assembly:	16.70 pounds

c. Primary Power: 22.0 V DC to 30.5 V DC, (27 V DC, nominal).

d. Power Consumption: 35 Watts, maximum (with 14 direct record amplifiers and one voice amplifier).

e. Record Bias Signal Frequency: 7 MHz

f. Data Signal Input Impedance: Greater than 10 K ohms or 93 ohms shunted by 100 pF (switchable).

g. Data Signal Input Level:

1. Four input levels; 100 mV rms, 300 mV rms, 1 V rms, or 3 V rms, selectable on the record amplifier.

2. Maximum input level: $\pm$30 V limited at 500 MW.

h. Voice Signal Input Impedance: 600 ohms.

i. Voice Signal Input Level: 50 to 750 m V rms or 2 V rms to 30 V rms (selectable).

1.4.5 Reproduce Monitor Module Assembly Characteristics

a. Dimensions:

1.	Length (depth):	11.25 in., maximum (including the mounting assembly).
2.	Width:	7.80 in.
3.	Height:	8.25 in. (including the mounting assembly).

b. Weight

1. Without mounting assembly: 11.25 pounds
2. With mounting assembly: 14.05 pounds

c. Primary Voltage: 22.0 V DC to 30.5 V DC, (27 V DC, nominal).

d. Power Consumption: 30 Watts, maximum.

e. Reproduce Amplifiers: Three each one can reproduce any tape data track selected by its front panel input selector switch.

f. Output impedance (each reproduce channel): 93 ohms.

g. Output level (each reproduce channel): 1 V rms, nominal.

1.4.6 Remote Control Chassis Assembly Characteristics

a. Dimensions:

1.	Chassis Length (depth):	5.00 in. (excluding protruding connectors on the rear)
2.	Chassis Width:	4.90 in.
3.	Chassis Height:	2.05 in.
4.	Panel Width:	5.75 in.
5.	Panel Height:	2.25 in.
6.	Panel Thickness:	0.25 in. (plus 0.06 in. plate subassembly)

b. Weight: 1.30 pounds

c. Primary Voltage: 22.0 V DC to 30.5 V DC (27 V DC, nominal).

d. Power Consumption: 1.5 Watts, maximum (when ALARM lamp is lit).

1.5 MODEL 12-B OVERVIEW

The Model 12-B is a magnetic recorder designed for airborne operation, i.e. data collection during flight.

The recorder consists of four separate units, the recorder transport, record module, reproduce monitor module and remote control unit.

a. The primary element of the mainframe is the tape transport.

b. The recorder amplifies the input signals and then records the signals on magnetic tape.

Operational control of the equipment is normally effected via the remote control chassis assembly.

To facilitate tape loading, a local control unit is incorporated in the record transport (accessible with the mainframe cover removed. Selection of local or remote operation is affected at the local control unit.

A block diagram of the various interconnections is shown in Figure 1-3. The recorder transport only includes elements directly connected with control of the magnetic tape motion. For normal operation, it is connected to the record module assembly via a cable, and all control instructions are received from the remote control unit.

1.5.1 Tape Transport

This comprises the tape transport and heads, associated control electronics, and general power supply for the recorder.

1.5.2 Tape Transport Mechanism

The tape deck carries the various tape drive and guide elements.

Three motors are used:

1. The capstan motor is of the printed circuit D.C. type, with a tachometer and pickup. The capstan is mounted on the motor shaft.

2. The reel motors are of the printed circuit DC type, and drive the reels via toothed pulleys. The two reels are coaxial.

The capstan motor is servo-controlled for speed. It is controlled by a servo system which compares the phase and frequency of the tachometer signal to a reference frequency. The motor speed signal is derived from a tachometer, locked to the capstan, and the reference frequency is obtained from a crystal-driven internal time base, or from an external time base.

For on-tape servo in the reproduce mode, the signal from an internal time base (IRIG time base: 200 kHz at 120 ips, and 1.562 kHz at 15/16 ips), can be recorded on any track. This frequency is obtained automatically according to selected tape speed.

The tape is driven directly by the capstan, mounted on the shaft of the capstan motor.

The two reels are mounted concentrically, transfer from one reel plane to the other being achieved by two tilted rollers (see Figure 1-4), and two rollers perpendicular to the tape plane.

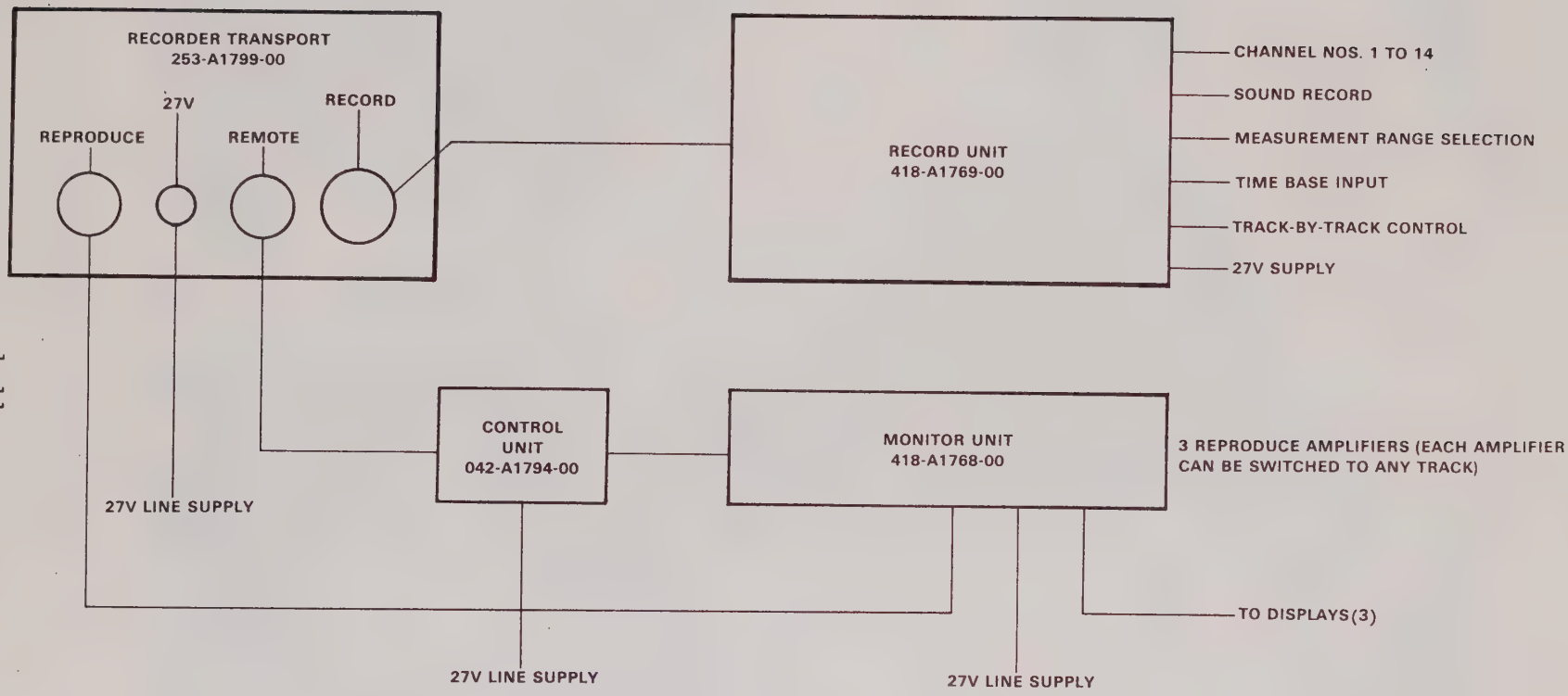


Figure 1-3. Block Diagram

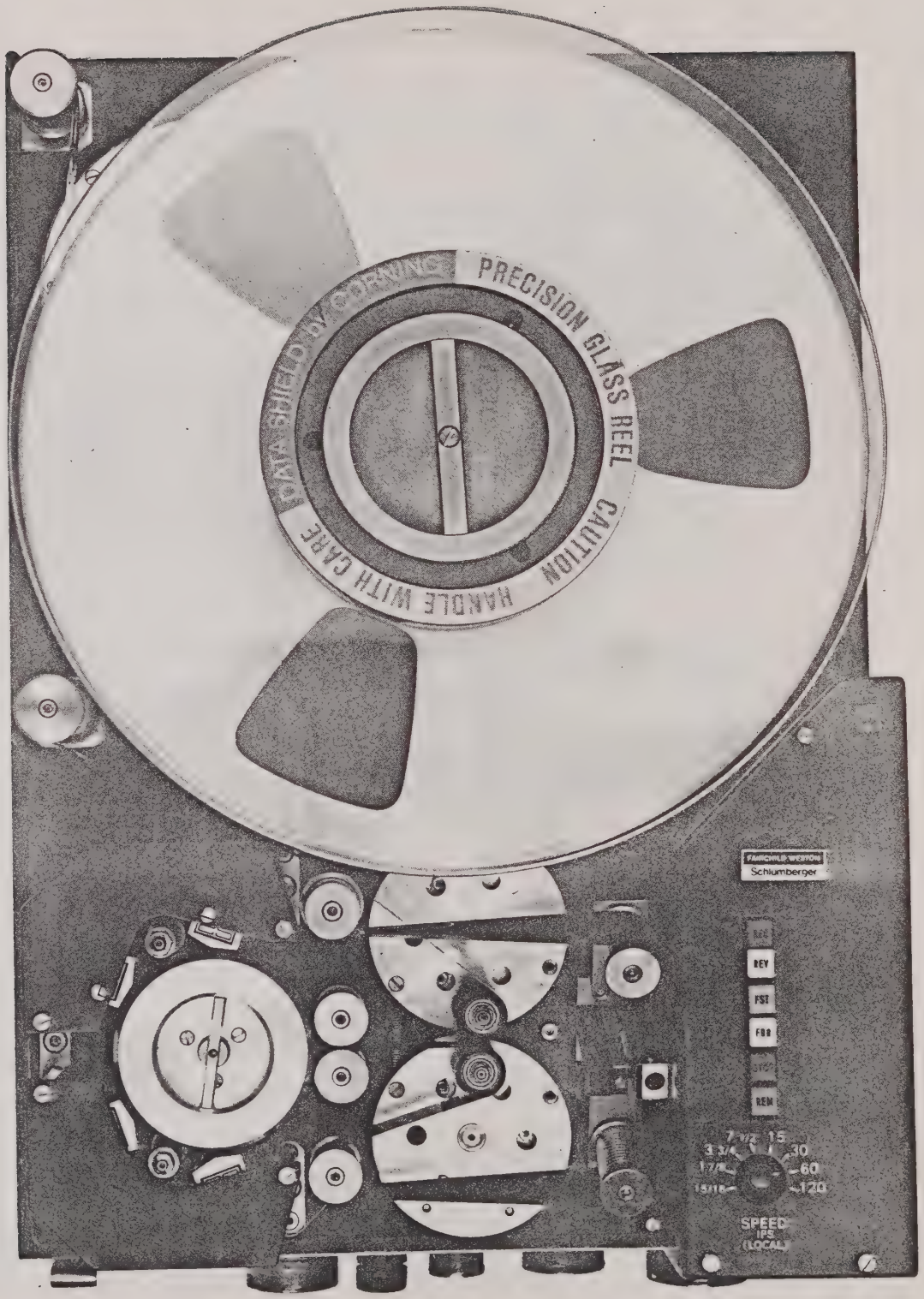


Figure 1-4. Tape Transport Plan View

A mechanical decoupling system is used to ensure constant tape tension across the magnetic heads. This system comprises two sensors. Motor torque is slaved to the position of these sensors, by means of a magneto-resistive transducer. Tape tension across the head is therefore constant, irrespective of variations in the speed, diameter, and state of load of the two reels. This system has the advantage of reducing strain on the tape, both during normal operation, and on start, stop, or change of speed. Flutter and ITDE are thus reduced.

In the event of power supply failure, a safety brake comprised of two metal belts, is applied to the tape drive.

1.5.3 Magnetic Circuits

The magnetic heads are mounted rigidly on the tape deck.

The circuits used have 14 tracks plus A and B (edge tracks), arranged in two interlaced heads, in accordance with IRIG standards. Data track width is 0.05 in., with a center-to-center dimension of 0.07 in. on tape. Tracks A and B are each 0.05 in. wide (and 0.008 in. in from the tape edge).

1.5.3.1 Control Electronics and General Power Supply

The following are located under the tape transport:

1. Tape transport card and servo card, these two cards being integral and coupled to the interconnection card.

2. Tachometer card.

3. Tape Transport Card and Servo Card

   These incorporate:

   a. Power supplies ($\pm$15, $\pm$12, and $\pm$17 V).

   b. Reel motor servo systems.

   c. Safety systems.

   d. Control logic (FWD, REV, FAST FWD, FAST REV, REC, STOP), and various safety circuits.

   e. Motor power amplifiers (capstan and reel motors).

4. Interconnection Card

   1. This card:

      a) Provides the "local/remote" control switching function.

b) Incorporates remote control data storage, part of the status circuits, and the record control circuits.

c) Provides data exchanges between the connectors of the three cards, accessible with the cover open, and located on the right of the tape transport, for:

- Local control of the recorder
- Magnetic head matching

5. Local Control Card

This card has priority over the remote control unit. It covers the following functions: FWD, REV, FAST, REC, STOP, remote control, and speed selection.

6. Head Driver Card

This card carries 16 identical amplifiers, which receive the signal from the record unit, and provides the proper constant current head driver circuitry.

1.5.3.2 Safety and Alarm System

In the event of an anomaly in operation of the tape transport or electronics, various safety systems incorporated in the recorder come into action.

1.5.3.3 Tape Breakage

Two opto-electronic devices provide the following functions:

1. The first stops the recorder automatically at a pre-determined point.

2. The other:

   a. Stops the recorder automatically in the event of tape breakage.

   b. Inhibits start-up if no tape is loaded.

1.5.4 Accidental Interruption of Power Supply or Voltage Drop

The recorder is designed for operation between 22 and 30.5 V.

Between 18 and 22 V, degradation of performance may be observed, the recorder then reverting to normal operation automatically when voltage level is re-established inside the rated range.

If voltage drops below 18 V, the recorder stops.

- If supply voltage is re-established at a value above 18 V:
  - Within 10 seconds: recorder restarts automatically.
  - After more than 10 seconds: manual restart is required, as follows:
- Two conditions are possible:
  - Unit under local control.
  - Unit under remote control.
- Local control:
  - To restart the tape transport, press the FWD or REV pushbutton, loading is automatic and the function is enabled.
- Remote control:
  - Move the switch to STOP.
  - Reselect the function.

1.5.5 Loading Safety System

This system inhibits the loading (tensioning) function, when the tape has not been threaded correctly i.e.:

1. Tape does not pass in front of optical detectors.
2. Tape not wound on tape tension sensors.

1.5.6 Tension Sensors Alarm

This alarm detects:

- An operating anomaly on one of the reel motors.
  - Detection of this anomaly stops the tape transport within 3.5 seconds.
- An operating anomaly on both reel motors. In this case, the tape transport stops immediately.

1.5.7 Abnormal Consumption by One of the Motors

This operating anomaly cuts off power supply within one second.

1.5.8 Incorrect Speed

Power supply is cut off after 10 seconds, and the STOP lamp flashes (the ALARM lamp on the remote control unit also flashes).

1.6 RECORD MODULE ASSEMBLY

This unit is housed in welded heavy gauge sheet steel. The record module includes its own power supply. It is connected to the recorder via an 8 ft. cable.

The record unit is fitted with 14 direct record plug-in amplifiers, (Figure 1-5) and one plug-in voice record amplifier (Figure 1-6), and includes a bias source. It receives the speed codes from the recorder, together with a time base for recording the tape speed reference track if required.

Record parameters are applied to the 14 individual input connectors.

1.6.1 Complementary Equipment

Flight Control Unit

This unit includes the following controls and indicators:

a. Tape speed.

b. Selection of Forward, Record, Fast Forward, and Fast Reverse functions. The selected function is enabled by operation of the Start/Stop switch.

c. Yellow alarm lamp, indicating as follows:

   1. Lamp on: recorder stopped but READY.
   2. Lamp out: normal recorder operation.
   3. Lamp flashing: operating anomoly detected.

d. Footage counter, indicating the quantity of tape run off (4-digit display). This counter can be reset by pressing the adjacent pushbutton.

NOTE

The "CALIBRATION" pushbutton is used on other versions of the Model 12. Its use is not relevant to operation of Model 12B. Accidental pressing of this button will not, at any time, cause any ill effects.

Following prolonged interruption of power supply, operation of the Start/Stop switch resets the tape transport ready for continuation of the test.

1.6.2 Reproduce Monitor Module Assembly

This unit provides the ability to reproduce the signal recorded on any track, either at the same time as the recording is being effected, or at any time subsequently if required.

The unit contains its own power supply operating directly from 27 volt DC input. Within this power supply is a separate regulator unit which supplies the necessary voltage levels for the reproduce head preamplifiers.

The reproduce monitor is fitted with three reproduce amplifier plug-ins (see Figure 1-7). Any tape track can be selected as the input to each amplifier by means of its individual front panel selector switch.

The outputs from each of the reproduce amplifiers are taken to output sockets, on the reproduce monitor assembly, and these are then available for connection to an appropriate display unit.

1.6.3 Direct Record Amplifier

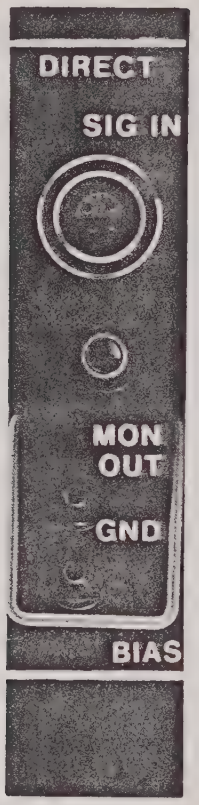


Figure 1-5. Direct Record Amplifier

This amplifier is in the form of a plug-in card, and carries the following on its front panel:

a. Signal input connector

b. Jack for substitution of reference voltages from the calibration module, in place of the signal.

c. Input level (after attenuator) test point (MON)

d. Ground terminal (electrical 0 volts)

e. HF bias current adjustment control.

Internal switches are used for selection of:

1. Input sensitivity: 100 mV, 300 mV, 1 V or 3 V rms.

2. Input impedance: 10K ohms or 93 ohms.

1.6.4 Voice Record Amplifier

Figure 1-6. Voice Record Amplifier

Voice commentary is recorded in parallel on tracks A and B, using a single card inserted in the record unit.

Voice data is brought in via a connector on the front panel of the Record module. No microphone is supplied.

This amplifier is in the form of a plug-in card, and carries the following on its front face:

- HF/LF mix output terminal
- Ground terminal

An internal switch with three positions, marked 1, 2, and 3 is used for adjustment of input sensitivity.

1. 1.5 to 50 mV rms.
2. 50 mV to 1.5 volts rms.
3. 1 to 30 volts rms.

1.6.5 Direct Reproduce Amplifier

Figure 1-7. Direct Reproduce Amplifier

This plug-in module has a front panel equipped with:

- A signal output terminal
- A ground terminal (Electrical 0 V)
- A gain adjustment potentiometer.

By removing the shielding, access is gained to the two standard switches and the seven adjustment potentiometers of the equalizer. These elements are marked on the shielding.

This amplifier contains hybrid circuitry and is equipped with an eight-speed equalizer.

SECTION 2

INSTALLATION

2.1 UNPACKING

Care should be taken when unpacking the Model 12-B. Rough handling of the unit may disturb critical adjustments or alignments performed at the factory. Upon arrival of the Model 12-B at the customer's facility, the following unpacking procedures should be performed.

a. Ensure that the shipping container is sealed when received. If the container is open, record this fact on the freight bill and notify the carrier immediately.

b. Check the shipment against the freight bill to ensure that the proper container has been received. Report any discrepancies to the carrier and Fairchild Weston in Sarasota, Florida.

c. Check shipping container for external damage. Look for dents, smashed corners, holes or protrusions.

d. Open shipping container and check contents with enclosed packing list. Record any missing items.

e. Verify that serial numbers of all assemblies and record and/or reproduce heads shipped with the Model 12-B agree with those listed on shipping document. Record any discrepancies and notify the factory if necessary.

2.2 EQUIPMENT INSPECTION

After unpacking the Model 12-B, inspect the equipment as follows:

a. Inspect the exterior for damage such as scratches, dents, broken switches, etc.

b. Inspect the interior for damaged components and loose or broken cable connections.

c. Ensure that all printed wiring assemblies are properly seated in their connectors.

d. Record any damage and notify Fairchild Weston immediately if necessary.

2.2.1 Reshipment

If the Model 12-B has to be returned for repair, prior arrangements must be made with the factory. Contact the nearest Fairchild service representative, or Fairchild Weston in Sarasota, Florida. Individual printed wiring assemblies found to be defective should also be returned to the factory for repair or replacement.

2.3 TAPE TRANSPORT, RECORD MODULE, AND REPRODUCE MONITOR MODULE INSTALLATION (see Figure 2-1).

2.3.1 Tape Transport

The record transport is installed in the aircraft, mounted on an anti-vibration kit. See Figure 2-2 for kit dimensions.

The anti-vibration kit is attached by 8 Allen screws #10.

Engage the recorder transport on the alignment pins, and hold firmly in place by means of the screw locking system at the front.

2.3.2 Record And Reproduce Modules

The record module assembly and the reproduce monitor module assembly are mounted in the aircraft on individual mounting assemblies. See Figure 2-3 for the mounting assembly dimensions.

1. Fix the mounting assemblies with 4 hex. screws #10.

2. Engage the record or reproduce module on the mounting assembly, and hold firmly in place by means of the screw locking system at the front.

2.4 REMOTE CONTROL CHASSIS INSTALLATION

The remote control chassis is installed by attaching it to the vehicle frame by the two captive Dzus fasteners in its front panel.

2.5 CONNECTIONS

Connect interconnecting cable assemblies as shown in Figure 1-1.

Connect the record transport, record module, reproduce monitor module, and the remote control chassis to the vehicle 27 V DC primary power source.

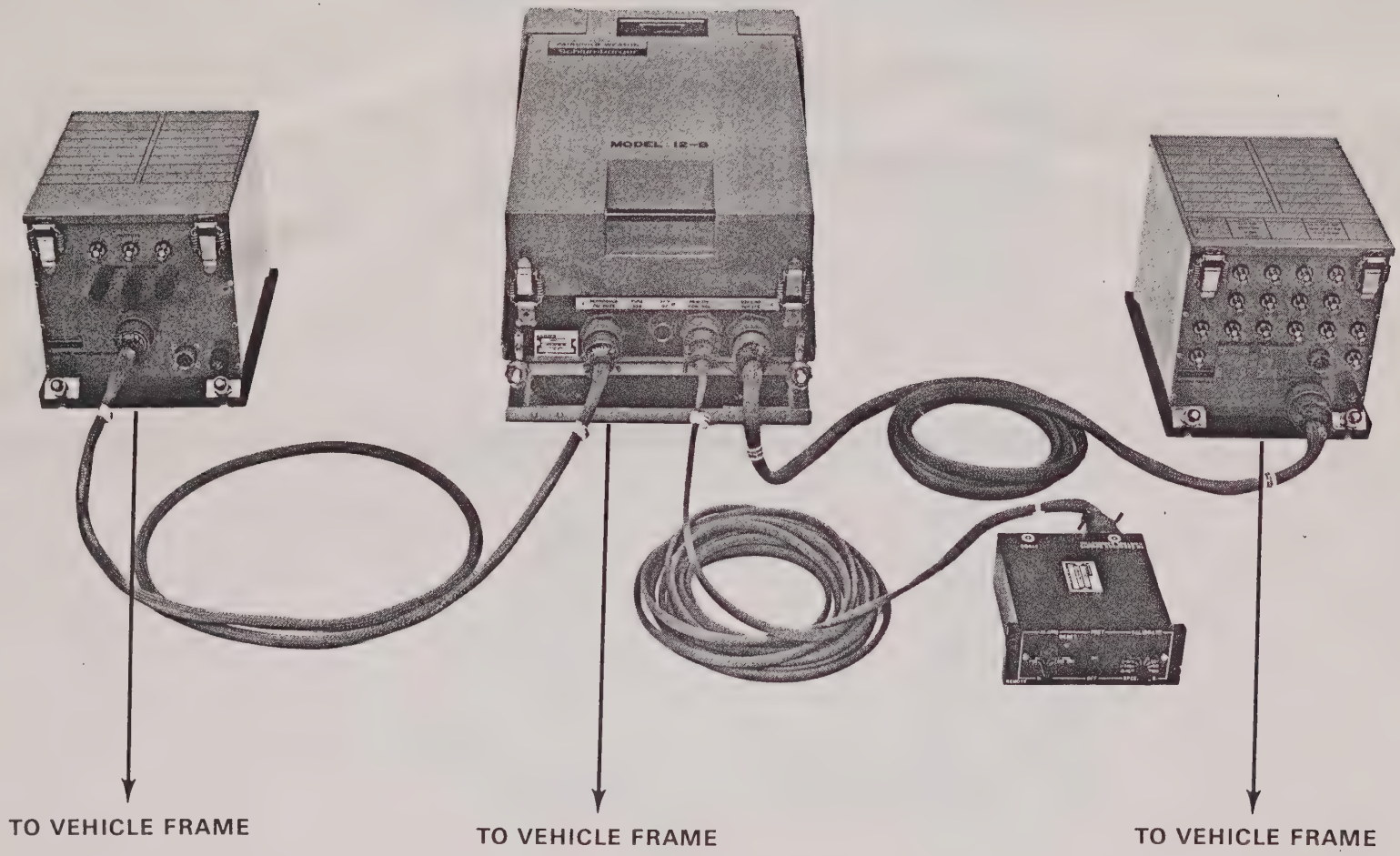


Figure 2-1. Tape Transport Record Module and Reproduce Monitor Module Installation

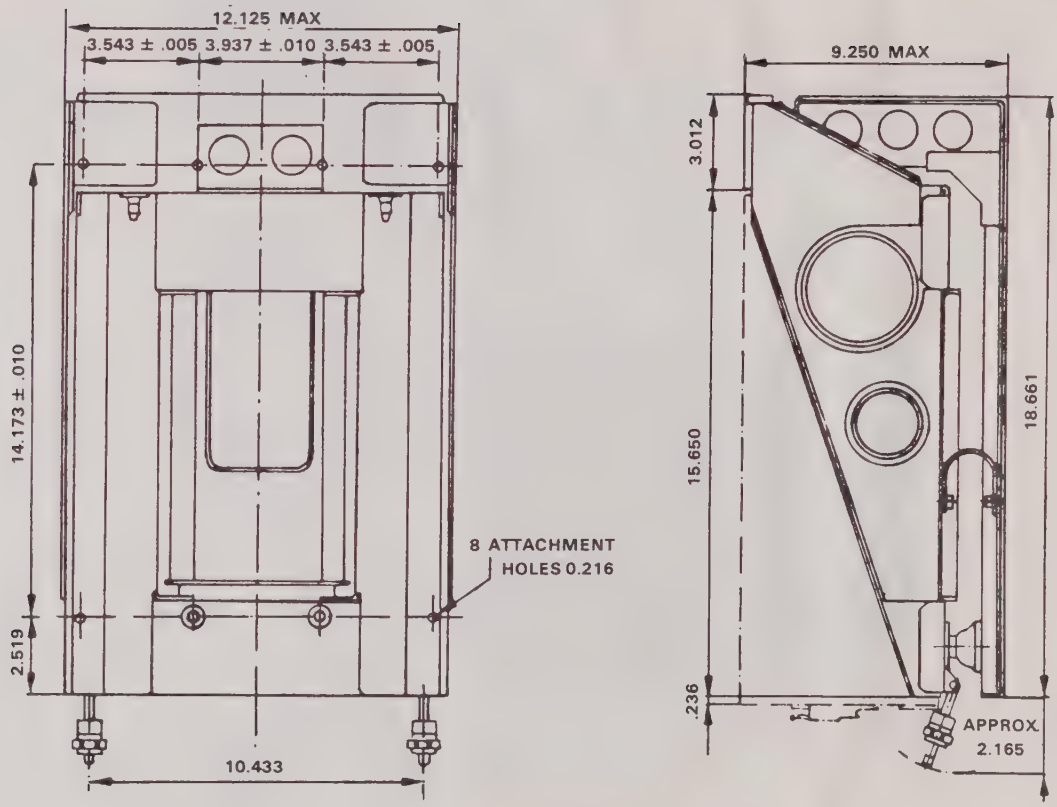


Figure 2-2. Anti-Vibration Kit Dimensions

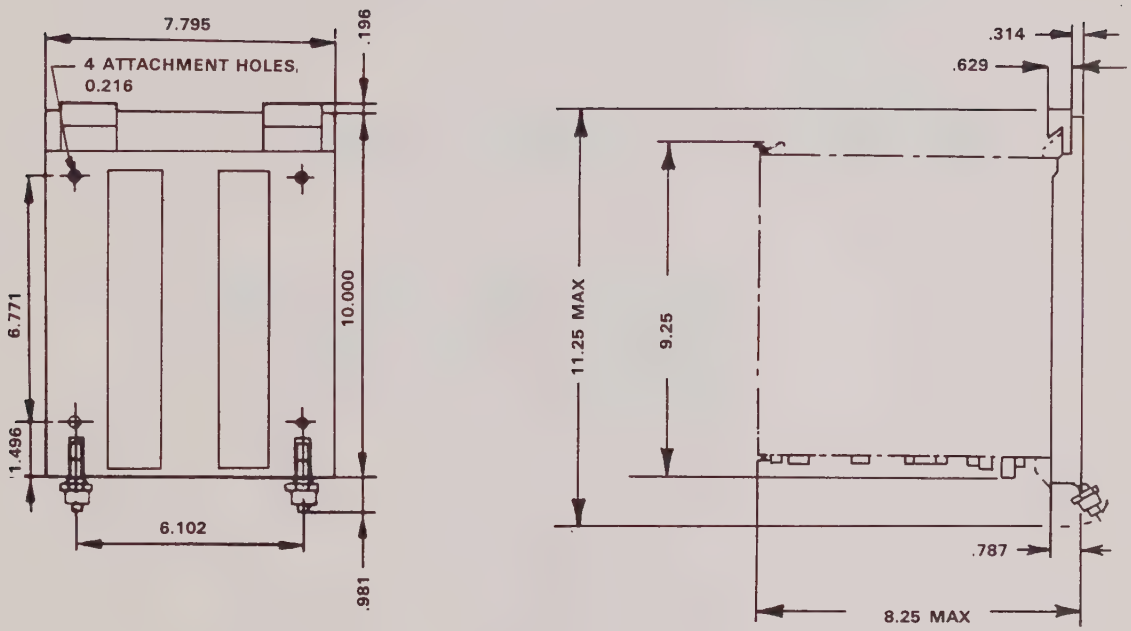


Figure 2-3. Mounting Assembly Dimensions

On the record module, connect:

1. Each signal input to BNC connectors marked "1 to 14".
2. Audio input to BNC Connector marked "VOICE".
3. Connector TB where appropriate (see below).

2.5.1 Utilization of TB Connector

When connected to any of the 14 record channels, equipped with a Direct amplifier, can be used to record a time base for capstan motor servo in the reproduce mode.

For this purpose, move the sensitivity selector to position 1 (100 mV rms).

Output level: 100 mV rms.

Time base switched automatically according to tape speed: 1562.5 Hz at 15/16 ips cm/s to 200 kHz at 120 ips.

NOTE

It may be noticed that two plates on the record unit cover unused sockets. These sockets are used on other versions of the Model 12. They are not relevant to operation of the Model 12B.

SECTION 3

OPERATION

3.1 GENERAL

The Model 12-B can be operated locally, by controls on the record transport or remotely, by controls on the remote chassis.

3.2 LOCAL CONTROLS AND INDICATORS

Figure 3-1 shows the location of the controls and indicators on the record transport. The index number for each control shown in Figure 3-1 keys the control or indicator to its nomenclature and functional description which follows.

NOTE

All pushbuttons are internally illuminated for immediate indication of recorder status.

Loading pushbutton [T] (Figure 3-1 - Index 1). This pushbutton is depressed to initiate correct tape tension, when the reels are in place and tape loaded.

[REC] (Figure 3-1, Index 2), Red pushbutton for selection of record mode for static adjustment or normal recording. In the latter case, simultaneous depression of either [FOR] or [REV] is required. Exit from the record mode is only available via [STOP] .

[REV] (Figure 3-1, Index 3), White pushbutton selects reverse tape motion.

[FST] (Figure 3-1, Index 4), Orange pushbutton selects fast tape speed. This function is effective only when [FOR] or [REV] is enabled. It is inhibited when [REC] is enabled.

[FOR] (Figure 3-1, Index 5), White pushbutton selects forward tape motion.

[STOP] (Figure 3-1, Index 6), Red pushbutton used to stop the tape transport. Inhibits all functions.

[REM] (Figure 3-1, Index 7), Green latching contact pushbutton, used to switch from local to remote control. A second push on the [REM] button unlatches it and returns the unit to local control.

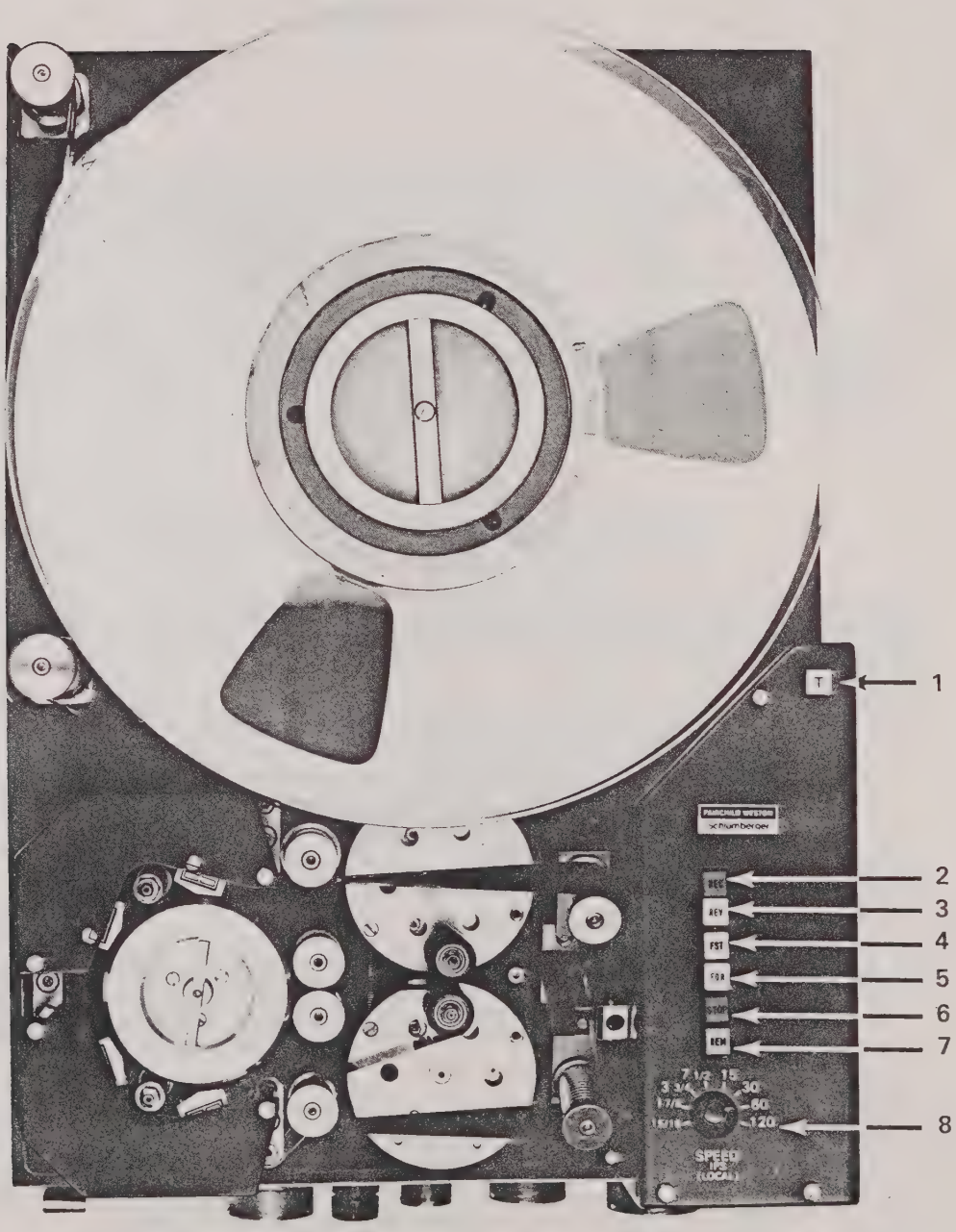


Figure 3-1. Tape Transport Control And Indicators

NOTE

After return from Remote Control condition, [STOP] MUST be pressed before any other function can be enabled locally.

SPEED IPS (Local, Figure 3-1, Index 8), 8-position selector marked "15/16, 1-7/8, 3-3/4, 7-1/2, 15, 30, 60, 120", selects one of the eight tape speeds. This selector is operational only under local control.

3.2.1 Control Functions

[STOP]	All functions inhibited.	Local Control: Effected by single push of [STOP] button. Remote Control: Effected when ON/OFF switch moved to OFF position (after lifting mechanicalilatch).
[FOR] [REV]	Selection of direction of tape motion at preselected speed.	These pushbuttons cannot be depressed simulatneously. If neither [REC] or [FST] is depressed, the machine runs in the replay mode.

[FST] Selection of fast (120 ips) forward or reverse, according to selection of pushbutton [FOR] or [REV]. The fast function is cleared by depression of [STOP]. The fast function cannot be selected independantly.

[REC] Depressed simultaneously with [FOR] or [REV], to select the record mode with the tape running forward or in reverse at selected speed. The record function can be selected on its own, for static calibration if required.

3.2.2 Return To Local Control (From Remote Control)

Stop tape run by moving ON/OFF switch to OFF. (on the remote control unit).

Release latched pushbutton [REM] on the local control module keyboard by pressing once. Lamps in [REM] and [STOP] pushbuttons stay on.

Depress pushbutton [STOP]. Lamp [REM] goes out, and lamp [STOP] stays on.

The recorder is now ready for operation under local control.

3.3 REMOTE CONTROLS AND INDICATORS (Figure 3-2)

Control and status functions available on the remote control unit are as follows:

- Controls

  - Selection of one of 8 tape speeds (preset control).
  - Selection of one of 4 functions: forward - record - fast forward - fast reverse (preset control).

  The function is enabled by throwing the "ON/OFF" switch. In order to move this switch between the two positions it is necessary to lift the mechanical latch which then "locks" the switch in whichever position is selected.

NOTE

The "CALIBRATION" pushbutton is used on other versions of the Model 12. Its use is not relevant to operation of Model 12B. Accidental pressing of this button will NOT, at any time, cause any ill effects.

3.3.1 Status Information

Four digit counter indicating length of tape run off in feet. This counter can be reset to zero by depression of a pushbutton located to the left of the counter.

Yellow alarm lamp, indicating as follows:

- On: Recorder stopped but READY
- Out: Normal operation
- Flashing: Abnormal operation (except as below)

NOTE

It is normal for the alarm lamp to flash during acceleration and deceleration of the tape transport.

3.4 INSTALLING MAGNETIC TAPE

The magnetic tape used should have beginning of tape (BOT) and end of tape (EOT) stickers as shown in Figure 3-4.

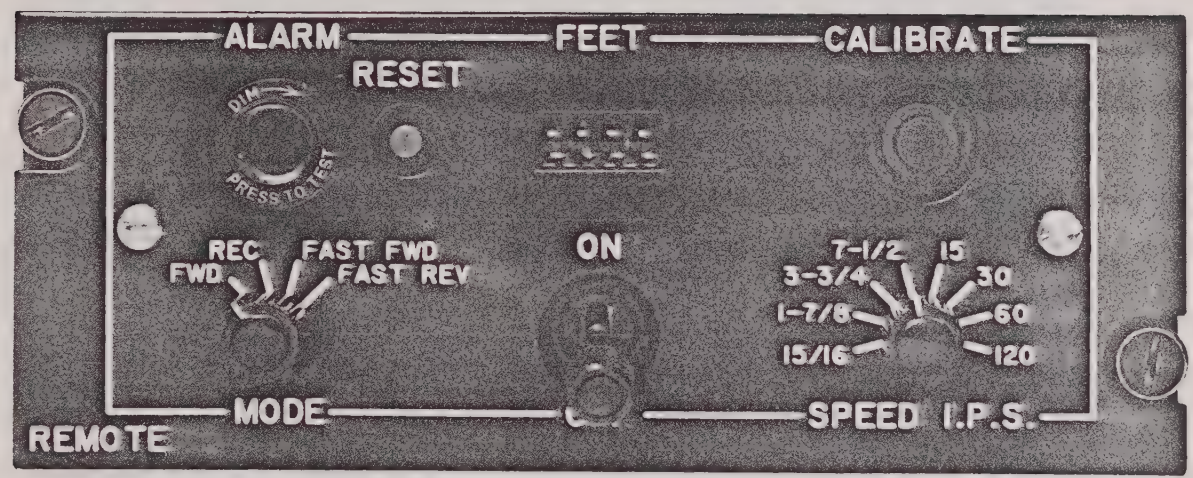


Figure 3-2. Remote Controls And Indicators

3.4.1 Description of the Reel Drive System (Figure 3-3)

The reel drive system includes:

1. Upper (lockable) cover
2. Upper hub
3. Upper reel slide-drive
4. Three studs spaced at 120°
5. Lower hub
6. Lower reel drive

3.4.2 Installing The Magnetic Tape

The type of tape recommended is AMPEX 797. It is possible that the equipment specifications may also be met using other good quality wideband instrumentation tapes which comply with WTO1553-C.

If BOT and EOT stickers are used, place them on the reverse side of the tape as shown in Figure 3-4.

Install the magnetic tape, following the path shown in Figure 3-5 and using the reel installation instructions in the next paragraph. After installation, check that the tape fits around both rollers between the heads and in the "tape present" detection slot.

3.4.3 Installing the Reels

- Hold the upper hub and loosen the locking cover (if necessary) by turning it counter-clockwise one or two turns.
- Push the slide-drive pin on the upper hub so that it protrudes on the side which lines up with the stud directly below it.
- Hold the lower hub and turn the upper hub counter-clockwise until the hubs lock together. All pins will now be in line.
- Carefully fit the loaded reel fully down onto the lower hub with the free end of the tape coming away clockwise.
- Hold the loaded reel from turning and turn the upper hub clockwise until it tightens up (when doing this, do not move the slide). CAUTION: DO NOT USE EXCESSIVE FORCE HERE.
- Press the slide-drive pin to unlock the two hubs.
- Load the empty reel on the upper hub, ensuring that it is seated properly.

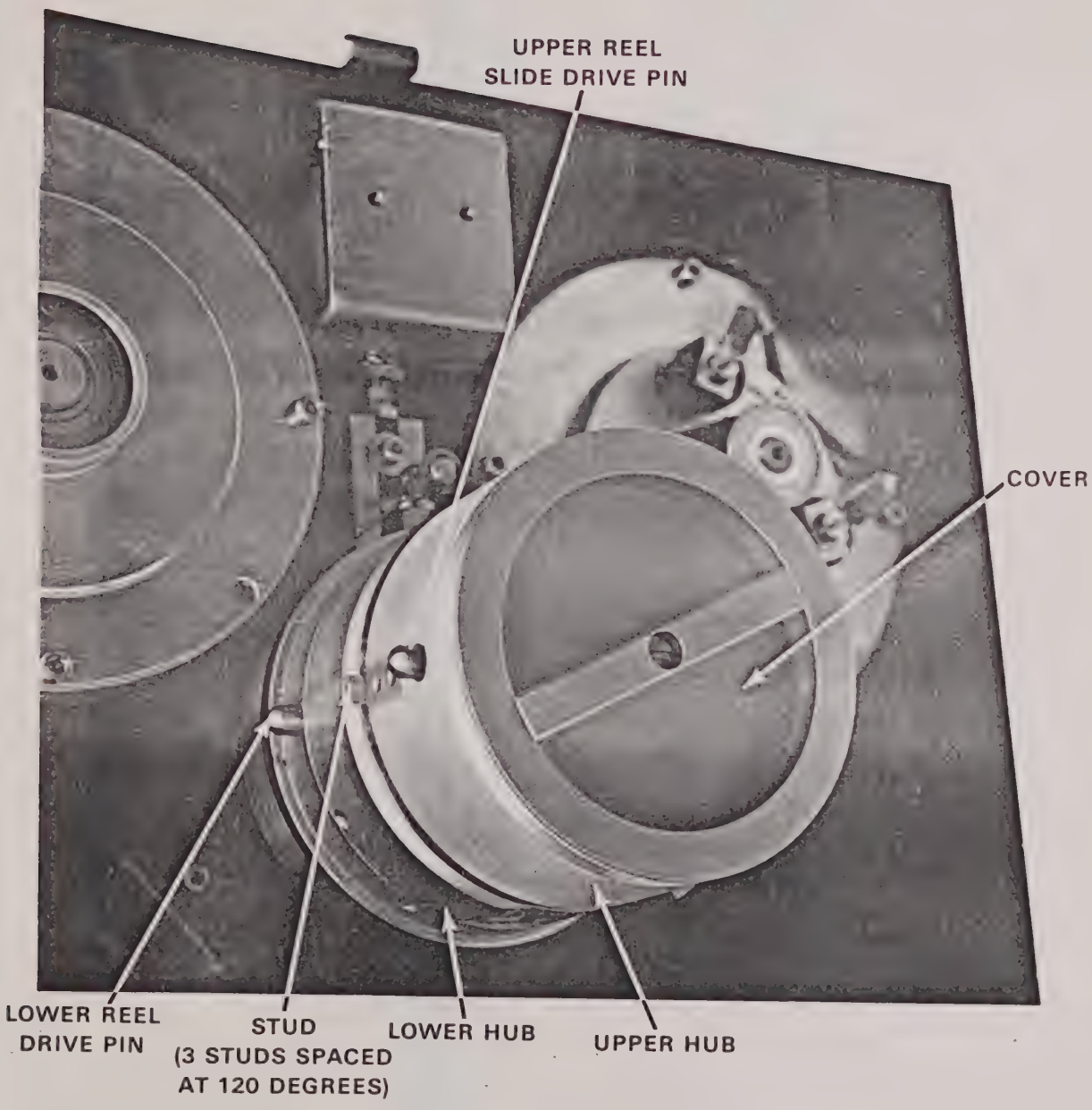


Figure 3-3. Model 12-B Dual Tape Reel Hub Showing Pins Aligned

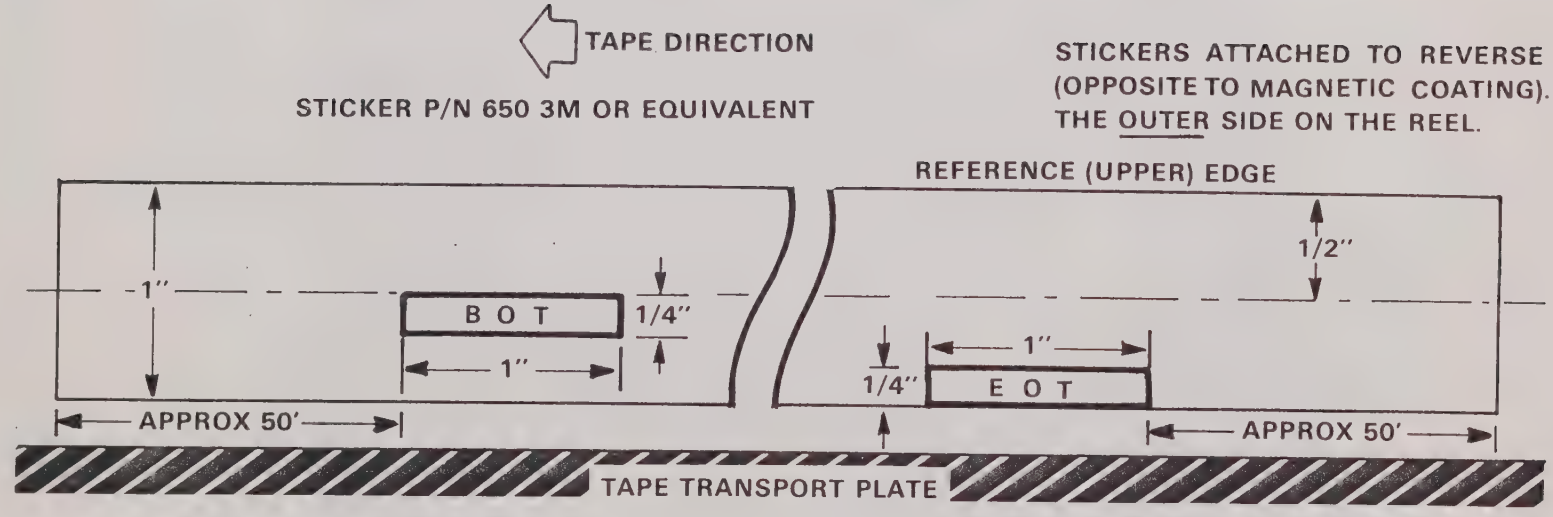


Figure 3-4. Position Of Stickers on Tape

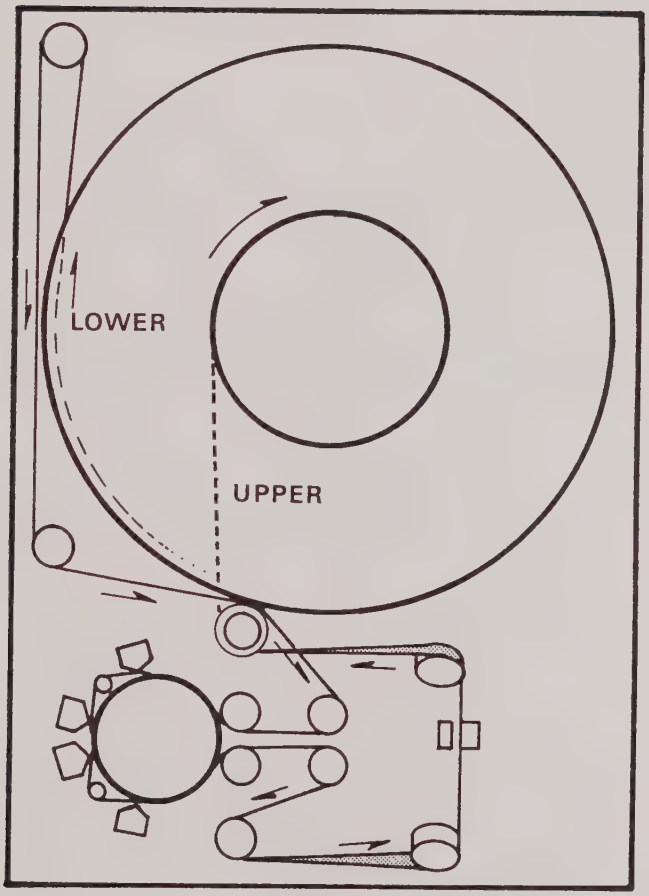


Figure 3-5. Tape Path

- Holding the upper reel, turn the locking cover clockwise until it tightens up. As before, do not use excessive force.

CAUTION

When there are no reels on the hubs, it is recommended that the locking cover be left in the counter-clockwise, or loose, position. DO NOT TIGHTEN the locking cover WITHOUT a reel on the hub.

3.4.4 Tensioning

When the magnetic tape is threaded, apply power to the recorder.

The STOP and ALARM lamps will flash. The tape must now be tensioned, to prepare the unit for recording or reproducing data. This tensioning can be effected by any of the following methods:

1. In local mode ("REM" lamp off).

   a. By depressing push-button [T] on the tape transport. The tape is tensioned and the indicator lamps cease flashing and remain lit. (STOP).

   b. By depressing push-button [FOR] or [REV] on the local control board. The tape is tensioned and starts moving at the selected speed. The "STOP" and "ALARM" lamps go out and the tape motion lamp illuminates.

2. In remote control mode (REM lamp on)

   a. By depressing the [T] push-button on the tape transport, as in local mode.

   b. From the remote control unit, by means of a forward or reverse motion order (same result as in local mode from the local control push-buttons).

3.4.5 Removing The Reels

The tape must be wound onto one reel only.

- Loosen the top reel cover to its stop.
- Remove the upper reel.
- Press the upper reel slide-drive so that it is aligned with a stud.
- Hold the lower reel and turn the upper hub counterclockwise until it clicks, then continue turning firmly to the stop (both drives and a stud are aligned).
- Remove the lower reel, holding it perpendicular to the reel holder spindle.

SECTION 4

OPERATOR MAINTENANCE

4.1 GENERAL

The Model 12-B is a precision instrument for the recording and reproducing of complex data. Its performance depends on the establishment of extremely close physical contact between the magnetic head tips and the microscopic particles in the magnetic coating on the tape.

The most usual cause of interference with this close contact, and therefore reduction in equipment performance, is dirt. Regular cleaning of the tape path and associated components is therefore essential (see Paragraph 4.2 below).

A second possible cause of reduced recorder performance is head magnetization. This phenomenon can build up gradually over a period of normal utilization of the recorder or can be caused by various external effects such as removing or replacing record amplifiers with the power switched onto the equipment.

The effect of head magnetization is distortion of the signals recorded onto the tape and reduced output of upper bandedge signals.

It is therefore necessary regularly to demagnetize the heads using the degausser supplied with the Model 12B (see Paragraph 4.3 below).

4.2 TAPE PATH AND MAGNETIC HEAD CLEANING (FIGURE 4-1)

Cleaning of the tape path and magnetic heads should be carried out on a daily basis during any and all periods when the equipment is in use.

The material used for cleaning must be either a lint-free cotton cloth, a cotton tip or bud as used for medical purposes or a smooth soft brush.

The solvent to be used with these materials must be Freon TF. UNDER NO CIRCUMSTANCES MUST ANY OTHER SOLVENTS BE USED.

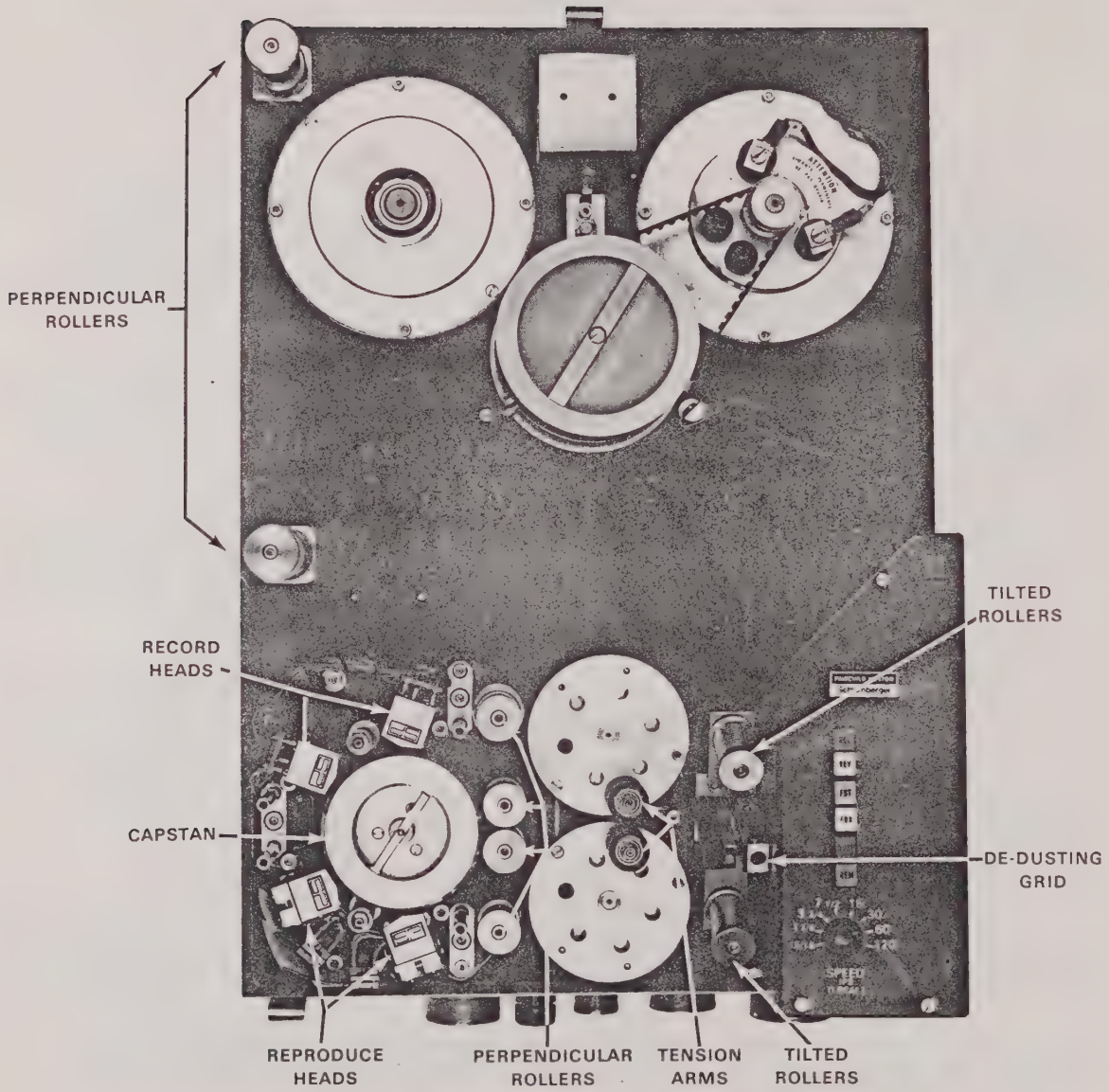


Figure 4-1. Tape Path and Magnetic Head Cleaning Guide

Freon TF is available in convenient 6 oz. containers, Stock No. NSN 6850-935-1082.

Freon TF is also available in aerosol form. If an aerosol is used, it is essential that it be sprayed onto the cleaning material for subsequent application to the tape path components. UNDER NO CIRCUMSTANCES MUST THE SOLVENT BE SPRAYED DIRECTLY ONTO ANY PART OF THE INSTRUMENT.

The procedure for cleaning the tape transport is as follows:

a. Shut off power supply.

b. Remove the magnetic tape from the tape path.

c. Loosen the capstan center screw.

d. Carefully pull the capstan out vertically.

   GREAT CARE MUST BE TAKEN DURING REMOVAL AND REINSERTION OF THE CAPSTAN OWING TO DANGER OF DAMAGE TO THE DELICATE MAGNETIC HEAD SURFACES BY INADVERTENT CONTACT BETWEEN THEM AND THE CAPSTAN MATERIAL.

e. Clean all the tape path elements (rollers, tension arms, magnetic head faces, capstan, cleaning grid, etc. per Figure 4-1).

f. Ensure that the capstan-to-shaft mating surfaces are clean and carefully replace the capstan and tighten the capstan center screw.

g. Rethread the magnetic tape through the tape path.

4.3 MAGNETIC HEAD DEMAGNETIZATION

Degaussing of the magnetic heads is recommended on a weekly basis when the recorder is in use daily. In additon, degaussing should be carried out after any repair or other servicing has been carried out.

If, at any time, a power failure is observed to occur WHILE THE INSTRUMENT IS IN THE RECORD MODE then head demagnetization, as soon as possible after the occurrence, is strongly recommended.

A bulk head degausser is supplied in the Accessory Kit of the Model 12B and the degaussing procedure is as follows:

a. Remove the record and reproduce head covers. (Reproduce heads are much less liable to magnetization than record heads but it is nevertheless recommended that both be demagnetized). Note: It is unnecessary to remove the capstan.

b. Connect the degausser to line power and turn on by depressing its switch before bringing it near to the heads.

c. Place it very close to the head stacks with its face parallel to the tape transport deck.

d. Keeping it parallel to the deck, move it very slowly back and forth several times close to the heads and so as to "treat" all four head stacks.

e. Very slowly and very smoothly pull it away from the head stacks, keeping it parallel to the tape transport deck.

f. When it is at least two feet away from the head stacks, remove power by releasing the switch.

IMPORTANT NOTE: INCORRECT USE OF THE DEGAUSSER CAN CAUSE, INSTEAD OF ELIMINATE, SEVERE MAGNETIZATION OF THE HEADS. IT IS ESSENTIAl THAT THE ABOVE INSTRUCTIONS BE FOLLOWED EXACTLY AND CARE TAKEN NOT TO MOVE THE DEGAUSSER RAPIDLY AND, ESPECIALLY, NOT TO SWITCH IT ON OR OFF WHEN CLOSE TO THE HEADS.

SECTION 5

SYSTEM TROUBLESHOOTING

The purpose of this section is to assist the user/operator in identifying which major assembly or possibly which plug-in module may be at fault in the event that the system fails to function properly.

This section does not treat the subject of repairing faults.

The following assumptions are made:

1. That no special test equipment other than a monitor display and/or a simple electrical meter is available.

2. That the system is correctly mounted in the aircraft when the failure occurs.

3. That no repairs other than fuse changing and/or major module or plug-in unit exchange will be attempted in the aircraft.

5.1 SYMPTOM: TAPE TRANSPORT WILL NOT RUN.

A. If no lamps are lit on the local control panel, check for presence of proper input voltage and polarity.

B. If 5.1.A checks out, then examine fuse F1 (10A) on the front of the tape transport unit.

C. Replace F1, if blown, and reapply power. If no lamps lit, recheck F1. If it is blown again, replace the transport or remove it for repair.

D. If the STOP lamp is flashing, check for proper tape threading and depress the tension switch "T". The transport should move enough to tension the tape and the STOP lamp should be lit, not flashing. If OK proceed to Step 5.1.E, otherwise replace the transport or remove it for repair.

E. Determine that the transport is in the local control mode by observing that the REM lamp is out. If not, place the unit in local control mode by pressing the latched REM button to put it in its higher or elevated position and then depress the STOP button. The REM lamp should go out and the transport will respond to local commands. If not, replace the transport or remove it for repair.

5.2 SYMPTOM: TAPE TRANSPORT WILL NOT RESPOND TO REMOTE CONTROLS.

A. Determine that the transort is operational by performing Steps 5.1.A - 5.1.E above, then, if OK,

B. Place the toggle switch on the Remote Control module in the OFF position. Check that the remote control cable W3 is properly connected at both ends. With the transport in the STOP mode, depress the REM button to its lower elevation. The REM lamp will light indicating that the transport is under remote control.

If the REM lamp does not come on, ensure that latched REM button is in DOWN position, note that transport must be removed for repair, but proceed to 5.2.C to ascertain whether remote control unit and cable must also be removed.

C. Set the switches on the Remote Control module to the FWD mode at a speed of 15/16 ips and move the ON-OFF switch to the ON position. Observe that the transport moves forward at 15/16 ips. Move the MODE and SPEED switches to their other positions and observe that the transport responds properly in each case. If the transport fails to obey any or all of these commands properly, the fault may be in the Remote Control module, Cable W3, or the transport. Remove them, in turn, for evaluation of possible failure.

Note: If the procedures above result in recovery of remote control capability but REM lamp remains unlit, this is almost certainly due to bulb failure. Data collection (recording) may be proceeded with pending later replacement of REM bulb. If remote control does not recover but local control functions, then data collection (recording) may again continue, given operator inconvenience of local control only.

5.3 SYMPTOM: TAPE TRANSPORT STOP LAMP BLINKS WHEN IN THE FWD OR REV MODES.

A. This is usually indicative of failure of the capstan servo to achieve phase lock. Check that the tape is threaded properly and that the input voltage is within specifications. If so, and the problem persists, replace the transport or remove it for repair.

5.4 SYMPTOM: DAMAGED TAPE

A. Replace the damaged reel of tape with a good reel. Check that both the full and empty reels are both properly seated and locked in position. Check that the tape is threaded properly according to the diagram (Figure 3-5 on page 3-9).

B. Run the tape forward for several minutes at 3-3/4 ips and observe the condition of the tape throughout its entire path, particularly how the tape packs on the take-up reel. If either edge of the tape is distorted or curled by contact with the reel flanges or any guide in the tape path, replace the transport or remove it for repair.

The preceding paragraphs described symptoms relating to motion and control of the tape recorder. The following paragraphs will address faults pertaining to recording and reproducing of data signals. Assuming a minimum of available test equipment and that the data flow involves all system components except the remote control unit, isolation of data handling faults becomes an iterative process.

5.5 SYMPTOM: LOSS OF DATA AT A MONITOR OUTPUT WHILE RECORDING.

A. Using monitor display equipment check that data is present at the source on the track to which the Reproduce Monitor is switched. If this check is not possible or if data is present proceed as follows:

B. Check that the transport is properly threaded and is in the forward-record mode as indicated by the lamps. If the STOP lamp is flashing, even though the "FOR" and "REC" lamps are lit, the unit will not record. Proceed as in Paragraph 5.3.A.

C. Check the fuse on the Record Module and replace if necessary. If it blows again, replace the module or remove for repair.

D. Check the fuse of the Reproduce Monitor and replace if necessary. If it blows again, replace the module or remove it for repair.

E. Move the other two channel switches to the track under investigation and monitor their outputs. If data is present at any output, then swap the reproduce cards in their slots to determine if the fault is due to a reproduce card failure or the Reproduce Monitor chassis. (If the result of putting a reproduce card from a working channel into the non-working one is to correct that channel, then fault is in the reproduce card. If fault is not corrected, trouble is in the reproduce monitor chassis itself.) Replace and/or return the failed part for repair. If no output can be obtained from the faulty track on any monitor channel, proceed to the next step.

F. Move the input data connection on the faulty track to another track and repeat Step 5.5.E. If data is present at the monitor outputs then the fault may be within the Record Module. Swap the two record cards in the slots for the tracks just tested. If the fault is thus identified as being in the record card, replace and/or remove the card for repair.

G. If, at this point, the fault has not been identified, load the tape transport with a previously recorded tape which is known to have provided data output, and proceed to Step 5.5.H. If this is not possible, then it is suggested that the components of the system be removed and returned for investigation in the following order - (1) the Record Monitor with Cable W1, (2) the Reproduce Monitor with Cable W2, (3) the Tape Transport.

H. With the previously recorded tape on the transport switch the monitor outputs to the recorded tracks. If data appears at any one but not all outputs follow Step 5.5.E. If no data appears the fault may be in the Repro Monitor, Cable W2, or the Transport. Remove them, in turn, for evaluation of possible failure.

I. If data appears at the outputs the fault may be in the Record Module, Cable W1, or the transport. Remove them, in turn, for evaluation of possible failure.

5.6 SYMPTOM: REPRODUCED DATA IS ERRATIC IN AMPLITUDE.

A. Check that Cables W1 and W2 and input and output cables are securely fastened. Assuming that the data being recorded is relatively unvarying in amplitude, then random, abrupt level changes in the reproduced signal are most often attributable to bad tape, dirt or oxide particles on the heads, or poor tape guiding. Clean the heads and other elements in the tape path in accordance with the procedures found in Section 4. Run the tape and examine the guiding according to Para. 5.4.B of this section. If all appears normal, replace the reel of tape with a new one. If the fault persists replace the transport or remove it for repair.

5.7 SYMPTOM: FLASHING ALARM ON THE REMOTE CONTROL MODULE.

A. This lamp will flash under certain conditions to indicate that the transport is in a non-operating mode (see Para. 3.3.1) and does not necessarily imply a failure has occurred. However, should the alarm flash while the transport is in the forward or reverse modes (not fast) then it indicates that the transport is not running at a controlled speed. Under this condition the STOP lamp on the transport control panel will also flash. Proceed as in Paragraph 5.3.A.

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